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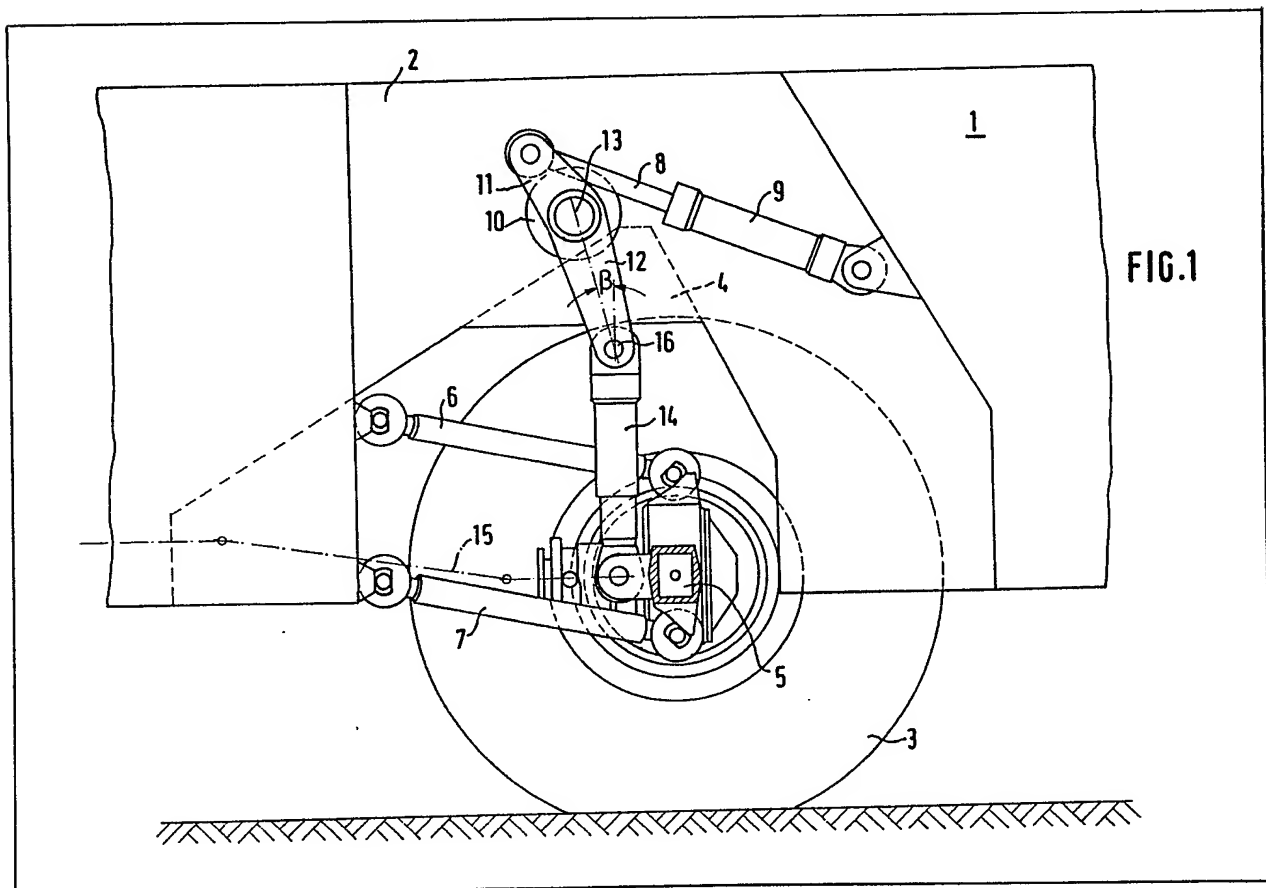
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(54) Wheel suspension

(57) A wheel or axle assembly is retractable into a corresponding wheel box (2) in a vehicle body (1). The axle assembly (5, 6, 7) is guided by means of parallel track arms (6, 7). The raising and lowering is effected by means of a

pivoted hydraulic piston and cylinder device (8, 9) whose piston rod (8) is articulatedly connected to one arm (11) of cranked lever (10) pivotable about a fixed pivot (13). The other arm (12) of the lever (10) is articulatedly connected to the axle assembly (5, 6, 7) via a spring strut with shock absorber (14). In the rod-travel position, the cranked lever (10) is pivoted to such an extent that its arm (12) slightly exceeds its bottom dead centre position, thus ensuring that this position is maintained even in the event of failure of the piston and cylinder device.



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FIG.1

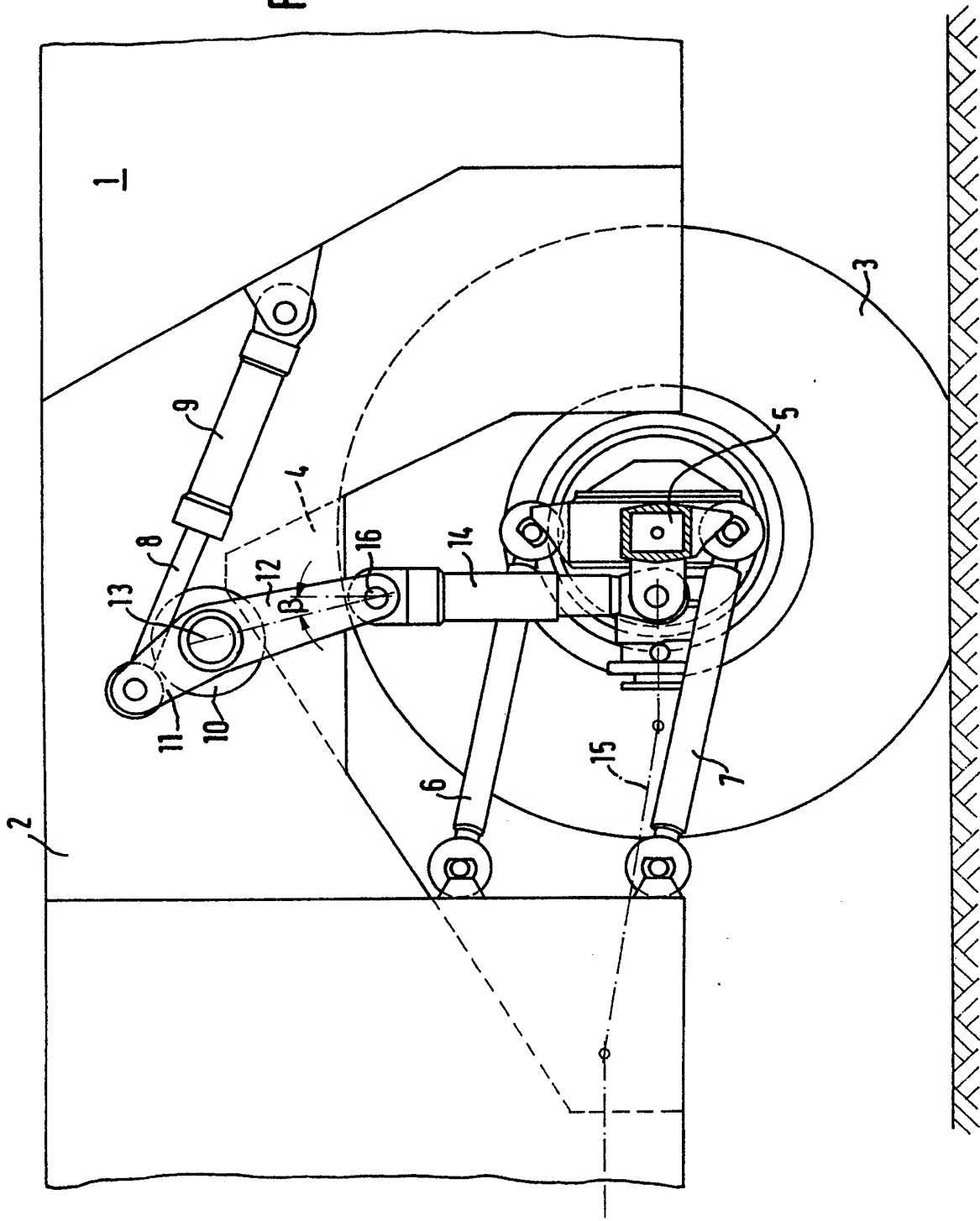
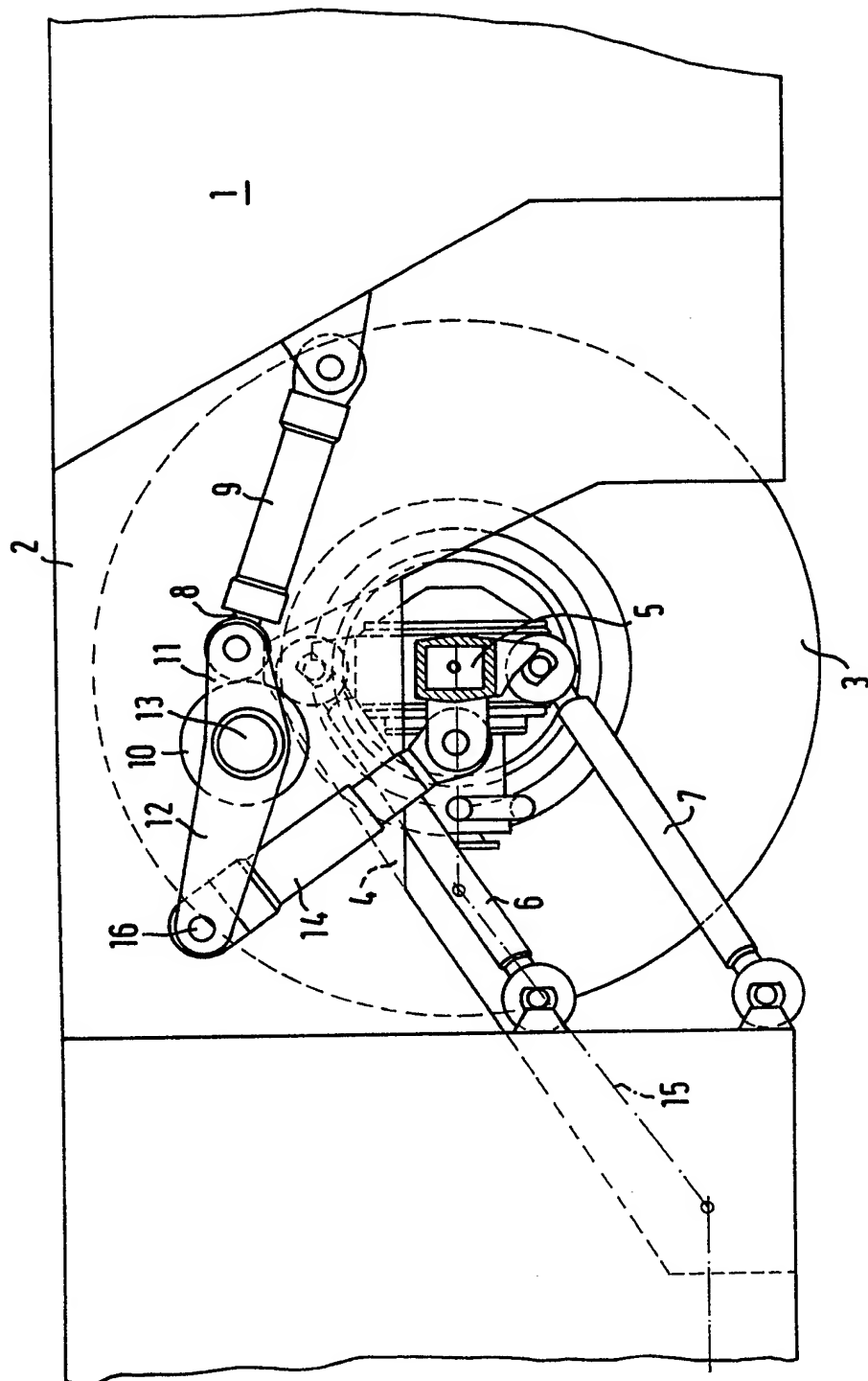


FIG. 2



SPECIFICATION

Wheel suspension

The invention relates to a wheel suspension for a wheel and/or wheel axle retractable into a vehicle body, with a track arm parallelogram for guiding the wheel and/or axle and with a pivoted hydraulic piston and cylinder device which at one end is secured to the vehicle body and which serves to raise and lower the wheel and/or axle.

- Retractable wheel assemblies of this type are necessary, for example, in amphibious vehicles. When these vehicles are changed over from land travel to water travel, the wheels have to be retracted so as to reduce water resistance and to improve manoeuvrability in the water. The same applies to land vehicles which, in the course of their use, have to be set down securely on the ground. Hitherto very expensive pivotal systems were necessary to control the raising and lowering operation, in particular for fixing the two end positions.

- Patent specification DE—OS 22 10 070 discloses a three-axle vehicle with an air-sprung rear drive axle and a so-called trailing axle which can be raised relative to the vehicle frame. For raising the trailing axle there is used a hydraulically or pneumatically operated piston and cylinder device which at the same time is designed as a shock absorber. The raised axle is held in this position by the pressure medium confined in the pressure chamber. Additionally, it is possible for the raised axle to be locked to the chassis frame by means of a suitable locking means, for example a hook.

- In the lowered position, the axle is connected with the chassis in conventional manner *via* separate air springs. In this position the piston and cylinder device acts as a conventional shock absorber.

- Patent specification DE—PS 538 257 discloses another arrangement for raising a vehicle axle by deforming the springs, which brace the axle against the chassis, by means of a hydraulic piston and cylinder device. In contrast to the above described arrangement, here the force of the hydraulic piston and cylinder device is deflected through about 90° *via* a rotatably mounted two-armed angled lever.

- When the axle is raised, the piston of the hydraulic piston and cylinder device is locked by the pressure fluid confined in the pressure chamber. When the axle is lowered, the hydraulic piston and cylinder device and angled lever are inoperative.

- Starting from the state of the art indicated above, the present invention is based on the object of devising a wheel suspension, in which both the raising and the lowering of the wheel and/or axle is effected by means of an hydraulic piston and cylinder device and which maintains the lowered position of the wheel and/or axle even in the event of failure of the hydraulic piston and cylinder device.

This object is achieved in that a slightly cranked

- lever is provided which is pivotable about a fixed pivot and has two lever arms, the free end of the pivoted piston and cylinder device is articulated to one lever arm, the other lever arm is connected articulatedly to the wheel or its axle and, when the wheel and/or axle is lowered, the other lever arm exceeds its bottom dead centre position, so that the pivoted piston and cylinder device is loaded against the mechanical end position.

- The displacement kinematics are so designed that, in the lowered position of the wheel or axle, by slightly exceeding the dead centre position of the lever arm the load moment loads the displacing piston and cylinder device against the mechanical end abutment. It is thereby ensured, even in the event of failure of the hydraulic system, that the road travel position is retained. Without this mechanical locking, in the event of failure of the hydraulic system, the wheel axle could swing upwards under the influence of the vehicle's weight, whereupon the vehicle body would be grounded on the roadway. If this were to occur whilst travelling, a serious accident would be unavoidable.

- According to an advantageous development, preferably a spring strut with shock absorber is interposed between the wheels or their axles and the other lever arm of the angled lever. Here, therefore, the spring is not tensioned when the wheels or axles are swung up or raised.

- One embodiment of the invention will now be described by way of example and with reference to the accompanying drawings, of which:

- Figure 1 shows the axle zone of a vehicle with a lowered axle assembly in the road-travel position; and

Figure 2 shows the same zone with raised or retracted axle assembly.

- A vehicle body 1 of a wheeled vehicle or floating body of an amphibious vehicle has wheel boxes 2 into which wheels 3 can be retracted or raised. Between the two wheel boxes 2 the vehicle body 1 has a recess 4 passing through transversely for the axle and for the parts provided thereon.

- A vehicle axle 5 is suspended in known manner from two parallel extending track arms 6 and 7 which ensure the vertical alignment of the wheels or axles in any position of the vehicle.

- A hydraulic piston and cylinder device comprises a piston rod 8 and a cylinder 9, which cylinder is pivotally connected to the vehicle body 1. A slightly cranked lever 10 with two lever arms 11 and 12, is pivotable about a pivot 13.

- The free end of the piston rod 8 is articulated to one lever arm 11, while the other lever arm 12 of the lever 10 is connected via an articulation 16 to the axle 5, in the illustrated example with an interposed spring strut with shock absorber 14. A drive shaft 15 is merely indicated in chain line.

- When the piston rod 8 is extended out, the entire axle and wheel assembly is pushed out downwards from the wheel box 2 *via* the cranked lever 10. In this case the lever arm 12 slightly exceeds bottom dead centre by the angle β . The

- direction of rotation of the load moment is reversed. The piston and cylinder device 8, 9 is now loaded by the load moment in the extending-out direction, i.e., against the mechanical end position. As a result of this reversal of the force direction, the whole assembly is secured in this position. This would also be the case even if the pivoted cylinder 9 were to lose its pressure fluid as result of it being damaged.
- 10 When the wheel axle is raised or retracted, a stable end position is also attained when the piston rod 8 reaches the abutment in the cylinder 9. In this position, the piston in the cylinder 9 is locked by a so-called hydraulic lock. If a loss of pressure fluid should occur here, only manoeuvrability in water will be reduced as the wheels 3 or axles 5 are lowered. On the contrary, without the mechanical locking according to the invention, failure of the hydraulic system during land travel
- 20 could lead to a serious accident.

CLAIMS

1. Wheel suspension for a wheel and/or wheel

- axle retractable in a vehicle body, with a track arm parallelogram for guiding the wheel and/or axle and with a pivoted hydraulic piston and cylinder device which at one end is secured to the vehicle body and which serves to raise and lower the wheel and/or axle, wherein a slightly cranked lever is provided which is pivotable about a fixed pivot and has two lever arms, the free end of the pivoted piston and cylinder device is articulated to one lever arm, the other lever arm is connected articulatedly to the wheel or its axle and when the wheel and/or axle is lowered the other lever arm exceeds its bottom dead centre position so that the pivoted piston and cylinder device is loaded against the mechanical end position.
2. Wheel suspension according to claim 1, wherein a spring strut with a shock absorber is interposed between the wheel and/or the axle and the other lever arm of the angled lever.
3. Wheel suspension substantially as herein described with reference to and as shown in the accompanying drawings.

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ABSTRACT:

A wheel or axle assembly is retractable into a corresponding wheel box (2) in a vehicle body (1).

The axle assembly (5, 6, 7) is guided by means of parallel track arms (6, 7). The raising and lowering is effected by means of a pivoted hydraulic piston and cylinder device (8, 9) whose piston rod (8) is articulatedly connected to one arm (11) of cranked lever (10) pivotable about a fixed pivot (13). The other arm (12) of the lever (10) is articulatedly connected to the axle assembly (5, 6, 7) via a spring strut with shock absorber (14). In the rod-travel position, the cranked lever (10) is pivoted to such an extent that its arm (12) slightly exceeds its bottom dead centre position, thus ensuring that this position is maintained even in the event of failure of the piston and cylinder device. □